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EXAMINER	
SUMMONS, BARBARA	
ART UNIT	PAPER NUMBER
2817	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/22/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/501,934	YAMAGUCHI ET AL.	
	Examiner	Art Unit	
	Barbara Summons	2817	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38* is/are pending in the application.

4a) Of the above claim(s) *24-38* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-12* is/are rejected.

7)☒ Claim(s) *5 and 13-23* is/are objected to.

8)☒ Claim(s) *1-38* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 July 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/21/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of the invention Group I. in the reply filed on 9/29/06 is acknowledged. The traversal is on the ground(s) that "the outstanding Restriction requirement has not established that examining each of the currently-pending claims together would result in an undue burden" as required by MPEP § 803. This is not found persuasive because the instant application is a national stage application under 35 U.S.C. § 371 and, therefore the Examiner is only required to point out that the inventions lack a special technical feature as per the Patent Cooperation Treaty (PCT), which has been done in paragraph 2 of the restriction requirement. That is, this application does not fall under the rules for U.S. restriction practice that Applicants are citing in the MPEP, but rather falls under the rules for restriction under PCT. It should be noted that even if the U.S. rules applied, there would be a serious burden on the Examiner to examine all the claimed inventions, as evidenced by Applicants' own "summary" of the invention which discusses first through "fifty-sixth" inventions (see pages 3-29 of the specification), and the fact that there are four foreign priority documents, suggesting at least four distinct Japanese inventions incorporated into the single U.S. application. Not to mention the fact that the search for a "printed circuit board" (Group I) does not overlap with the search for an "electronic component comprising a shield structure" (Group II), which could be considered subcombinations that may be usable together under the U.S. rules.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 24-38 are withdrawn from further consideration pursuant to 37 CFR § 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 9/29/06 (see above).

Claim Objections

3. Claims 5 and 13-23 are objected to under 37 CFR § 1.75(c) as being in improper form because a multiple dependent claim cannot depend from another multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claims 5 and 13-23 have not been further treated on the merits.

4. Claims 4 and 10 are objected to because of the following informalities:

In claim 4, on line 2, "the surface" lacks strict antecedent basis in the claims and is not particularly clear since it is not an inherent surface like the also recited "the rear surface" (see line 3). Therefore, the Examiner suggests:

In claim 4, on line 2, changing "the surface" to - - the filter mounting surface - - or something similar; and

In claim 10, on the next to last line thereof, changing "the surface" to - - the filter mounting surface - - or something similar. Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 3 and 4/1 and 4/3 are rejected under 35 U.S.C. § 102(b) as being anticipated by the utility document JP 55-86371 (cited by Applicants).

Fig. 4 of JP 55-86371 discloses a printed substrate 10 for mounting a surface acoustic wave (SAW) filter (see also Figs. 1, 2 and 5) comprising: an input side terminal electrode 18 (i.e. with via hole 13) in a filter fitting region 12 and with a wiring extending to the left in Fig. 4, and an output side terminal electrode 18 (i.e. with via hole 14) in the filter fitting region and with a wiring extending to the right and upward in Fig. 4; a slit 11 pierced through the printed substrate 10 (see Fig. 6) in the filter fitting region such that the slit 11 intersects a straight line with joins the input side terminal and ant output side terminal (i.e. a straight line drawn between via hole central via hole 13 to either one of via holes 14 intersects the slit 11); and since at least a portion of the wirings for the input/output terminal electrodes 18 extend left-to-right in the figure, and the slit 11 extends up-down in the figure, the direction the slit extends intersects the direction in which each of the wirings extend. Regarding claim 4, the via holes 13 on the top and bottom in the figure connect the mounting surface of the printed substrate 10 to the rear surface ground 18 that also isolates the input/output terminals.

Note that a translation of this document from the PTO translation staff has been requested, and will be available upon Applicants' response to this Office action.

7. Claims 6 and 7 are rejected under 35 U.S.C. § 102(b) as being anticipated by Sakurai et al. JP 11-195852 (cited by Applicants).

Fig. 7 of Sakurai et al. discloses a printed substrate 20 for mounting a filter 1 comprising: an input side terminal electrode 24 (i.e. the part inside dashed box 1) and an output side terminal electrode 25 in a fitting region (inside dashed box 1) for the filter; and a wiring for the input terminal 24 and the output terminal 25, wherein each of the wirings extend in a direction which is parallel to the transmission direction of an input signal within the filter. That is, the upper arrow in Fig. 8 shows the transmission direction of the input signal from input IDT (interdigital transducer) to output IDT, and the filter must be placed in box 1 so that either: (1) the Fig. 8 filter is placed upright in the box 1 of Fig. 7 so that the lower bars of the L-shaped wirings 24 and 25 are parallel to the transmission direction; or (2) the Fig. 8 filter is placed in box one such that the transmission direction runs in the direction of the slit between grounds 50 and 51 in the box in Fig. 7 and the upper legs of the wirings 24 and 25 are then parallel to the transmission direction. Note that in either case, the other of the lower bar of the L-shaped wirings and the upper leg of the L-shaped wirings is then orthogonal to the transmission direction, and each L-shaped wiring has an elbow where the lower bar and the upper leg meet, that is inherently a "predetermined distance" from the filter fitting region/dashed box 1. See also the machine translation provided as Attachment 1.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claim 2 and 4/2 are rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over the utility document JP 55-86371.

Although JP 55-86371 does not particularly point out the mounting direction of the filter of Fig. 1 that has a transmission direction from the input to the output IDT, it would be practical to mount it with its inputs 3 to the left near the input via holes 13 of Fig. 4, and with its outputs 4 to the right near the output via holes 14 of Fig. 4 such that the left-to-right transmission direction would have been orthogonal to the up-down direction that the slit 11 extends. Regarding claim 4, see paragraph 6 above.

However, if this were not the case, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of JP 55-86371 by having mounted it so that the transmission direction of the filter was left-to-right and orthogonal to the slit extension direction, because such an obvious modification would have been the mere rearrangement of the parts in what amounts to an art recognized alternative mounting arrangement, and would have provided the benefits of ease of connection due to shorter wires for connection of the input terminals on the piezoelectric substrate 1 of the filter to the input output pins 6/7 of the package,

since the input/output terminals would be more closely aligned in this manner than if the piezoelectric substrate were mounted in any of the other art recognized alternative directions in the package and on the printed substrate.

10. Claim 8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakurai et al. JP 11-195852 (cited by Applicants) in view of Onishi et al. U.S. 6,710,682.

Sakurai et al. discloses the invention as discussed above, except for the predetermined distance between the elbow of the L-shaped wirings 24 and 25 (Fig. 7) and the filter fitting region (dashed box 1) being "less than or equal to 10mm.

The Examiner takes Official Notice that 10mm is an extremely large value when speaking of dimensions of SAW devices. In evidence thereof, Onishi et al. discloses a similar SAW filter with two IDTs (transversal type SAW filter) and gives its dimensions as 1.5mm x 1.0mm (see col. 8, lines 30-36).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the printed substrate for mounting a SAW filter of Sakurai et al. (Fig. 7), if even necessary (i.e. the dimensions may already be in the recited range), such that the distance from the elbow of the wiring lines 24/25 to the filter fitting region (dashed box 1) would have been less than or equal to 10mm, because such SAW filters are typically in the 1.5mm x 1.0mm size range, and one of ordinary skill would have been motivated to put the printed substrate connecting wirings less than 10 times that far away due to the known desirable result in the art, and suggestion by Onishi to miniaturize such devices (see Onishi col. 1, lines 18-20).

11. Claims 9/6 and 9/7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakurai et al. JP 11-195852 (cited by Applicants) in view of Tanaka et al. U.S. 6,781,483.

Sakurai et al. discloses the invention as discussed above, except for being silent as to the material composition of the piezoelectric substrate of the SAW filter.

Tanaka et al. lists all typical and well know art recognized alternative piezoelectric substrate materials used in SAW filters, and includes langasite (see col. 6, lines 19-24).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the printed substrate/SAW filter of Sakurai et al. (Figs. 7 and 9), if even necessary, by using langasite as the piezoelectric substrate, because Sakurai et al. is silent as to the composition of the substrate, thereby suggesting that any well known piezoelectric substrate, such as langasite, would have been usable therewith, and because substituting langasite for other piezoelectric substrates would have been the mere substitution of art recognized alternative piezoelectric substrates, as suggested by Tanaka (ibid.), and as would have been known by one of ordinary skill in the SAW filter art.

12. Claim 9/8 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakurai et al. JP 11-195852 (cited by Applicants) in view of Onishi et al. U.S. 6,710,682 as applied to claim 8 above, and further in view of Tanaka et al. U.S. 6,781,483 for the same reasons given in the immediately preceding rejection.

13. Claims 10 and 11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sone et al. GB 2 268 000 (cited by Applicants) in view of Sakurai et al. JP 11-195852 (cited by Applicants).

Figs. 3 and 4 of Sone et al. disclose a printed substrate 20A with input/output terminal electrodes 24/26 (i.e. the area of 24/26 at 24a/26a) in the fitting region of the filter and a through hole 40 that electrically connects together ground 22 on the mounting surface (Fig. 3A) of the printed substrate and the rear surface (Fig. 3B) of the printed substrate that has also been grounded 22.

However, Sone et al. does not show the terminal electrode wirings having a portion that extends orthogonal to the transmission directions of the filter being left-to-right from the input to the output.

As discussed previously Sakurai et al. discloses such L-shaped wirings (Fig. 7) such that part of the wiring is parallel to and part is orthogonal to the transmission direction, the wiring.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the printed substrate of Sone (Figs. 3 and 4) by having provided L-shaped wiring lines extending from the input/output terminals instead of straight lines, because such an obvious modification would have been merely the substitution of art recognized alternative wiring connections to the filter as suggested by the exemplary teaching thereof by Sakurai (see Fig. 7 vs. Fig. 6), which would have been obviously provided based upon where the other devices requiring connection to the filter would have been located on the printed circuit board.

14. Claims 12/10 and 12/11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sone et al. GB 2 268 000 (cited by Applicants) in view of Sakurai et al. JP 11-195852 (cited by Applicants) as applied to claims 10 and 11 above, and further in view of Wakamori U.S. 5,162,822.

The Sone/Sakurai combination discloses the invention as discussed above, except for the recited size of the through hole.

Wakamori discloses a similar SAW filter having a printed substrate with multiple through holes 12 (see Figs. 2, 3 and 8) connecting the upper and lower grounds of the printed substrate to prevent interference between the input and output of the SAW filter (see e.g. the abstract). These through holes have the approximate recited size since the pads shown in Fig. 3A have dimensions a and b of 0.5mm. Additionally, the Examiner takes Official Notice that it would have been obvious to one of ordinary skill in the art to set the size and spacing of the through holes based on the frequency to be blocked (see section [0018] of Attachment 2 that is the translation of the similar reference JP 6-120711, cited by Applicants).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced the single through hole of the Sone/Sakurai combination with multiple though holes, as suggested by the exemplary teaching thereof by Wakamori (Figs. 2, 3 and 8), because such an obvious modification would have been merely a well known art recognized alternative through hole structure for performing the same function of preventing interference between the input and output of a SAW filter, as suggested by Wakamori (abstract), and because the

references are silent as to the specific diameter of the through holes, thereby suggesting to one of ordinary skill in the art that any well known through hole size for the desired filter application would have been usable therewith, and because one of ordinary skill in the art would have chosen the through hole size of between 0.3mm and 0.5 mm based upon the specific frequency to be blocked, this would have been common knowledge of one of ordinary skill, as is also evidenced by the other art of record (see e.g. JP 6-120711, section [0018] cited by Applicants).

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barbara Summons whose telephone number is (571) 272-1771. The examiner can normally be reached on M-Th, M-Fr.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bob Pascal can be reached on (571) 271-1769. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

bs
December 18, 2006
(2 Attachments)
machine translations

Barbara Summons
BARBARA SUMMONS
PRIMARY EXAMINER

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the printed-circuit board unit equipped with suitable wiring structure to mount high pass filters, such as wiring structure of a printed-circuit board of carrying piezo-electric devices, such as a piezo-electric filter, especially an SAW filter, in a printed-circuit board.

[0002]
[Description of the Prior Art] In the field of communication equipment, the request of RF-izing is increasing every year and RF-ization is required also from piezo-electric filters, such as an SAW filter and a multiplex mode filter. It has generated, when the problem on the property which was not generated when the filter whose frequency band is about several 10MHz was conventionally carried on a printed-circuit board carries piezo-electric devices, such as an SAW filter corresponding to high frequency bands, such as 800MHz of recent years, and 1.5GHz, in printed-circuit boards, such as a walkie-talkie, and the fault that a desired filter shape is not obtained especially is pointed out. this invention person conducted the following experiments and reproduced the above-mentioned fault so that he may check this point. Namely, drawing 10 (a) (b) And (c) Transverse-plane drawing of longitudinal section showing the structure of the SAW device as an example of the conventional piezo-electric device, It is a flat-surface cross-sectional view and a bottom view, and is drawing 11 (a). And (b) The procedure of mounting this SAW device on a printed-circuit board, And it is the perspective view showing the condition after mounting, drawing 12 is drawing showing the filter shape of the mounted SAW device, and drawing 13 is drawing showing the filter shape of the SAW device of the simple substance which is not mounted. While a top face fixes the SAW device chip 3 to the inner base of the concave ceramic package 2 which carried out opening, the SAW device 1 shown in drawing 10 Bonding connection of a step 4, the electric conduction pads 6 (6a, 6b, 6c) and 7 (7a, 7b, 7c) formed on five, and the electrodes 8 (8a, 8b, 8c) and 9 (9a, 9b, 9c) formed on the chip 3 is made with the wire 10 by one to one, respectively. Each electric conduction pads 6 (6a, 6b, 6c) and 7 (7a, 7b, 7c) Two or more electric conduction patterns 11 wired within and without the package 2 are minded. It connects with the output side terminal block 12 (output terminal 12a, grounding terminals 12b and 12c) and the input-side terminal block 13 (input terminal 13a, grounding terminals 13b and 13c) which were formed in the package base (or side face) electrically by one to one. The closedown of the top face of a package 2 is carried out with a lid 15.
[0003] In carrying the SAW device 1 equipped with such a configuration on a printed-circuit board (henceforth the printed circuit board) 20 Drawing 11 (a) While forming the common ground pattern 21 which covers the front face of the printed circuit board 20 beforehand on the whole surface, and consists of a metal membrane so that it may be shown By forming only in output terminal 12a of the base of the SAW device 1 and input terminal 13a, and a corresponding part the rectangle annular isolation fields (insulating region to which the substrate side was exposed) 22 and 23, respectively Isolation formation of the output circuit pattern 24 and the input circuit pattern 25 is carried out to each isolation field 22 and the 23 interior. The whole pattern located in the outside of the I/O circuit patterns 24 and 25 is used as a common ground pattern 21. Thus, if in charge of measuring the filter shape of the mounted SAW device 1, it measured by connecting with a measuring instrument machine through an input side and the output side coaxial cables 30 and 31 to the input circuit pattern 24 and the output circuit pattern 25,

respectively like drawing 11 (b). Drawing 12 is a graph which shows the property of the SAW device mounted like drawing 2 , and drawing 13 is a graph which shows the property of the SAW device simple substance before mounting. In addition, each graph shows what performed calibration processing in consideration of the effect of coaxial cables 30 and 31. That is, when the I/O grounding terminals 12b, 12c, 13b, and 13c of the SAW device 1 were connected with the common ground pattern 21 on a printed circuit board, respectively, compared with the property (drawing 13) before mounting in the printed circuit board 20, it became clear that 20dB or more especially of damping properties deteriorated in a low frequency side from a passband.

[0004]

[Problem(s) to be Solved by the Invention] the case where this invention was made in view of the above, and piezo-electric devices, such as a piezo-electric filter, are carried on a printed-circuit board -- also setting -- the device before loading -- it aims at offering the printed-circuit board unit from which a filter shape equivalent to the property in an independent condition is obtained.

[0005]

[Means for Solving the Problem] The input terminal and output terminal by which invention of claim 1 has been arranged along the two sides where a package base counters each other, respectively in order to attain the above-mentioned purpose, The piezo-electric device equipped with the grounding terminal arranged at the this input terminal and output terminal side, respectively, The input circuit pattern respectively corresponding to [are a printed-circuit board unit and] said input terminal and output terminal in said printed-circuit board top and output circuit pattern which consist of the printed-circuit board carrying this piezo-electric device, The isolation field which surrounds some of these inputs and each output circuit patterns [at least], In that in which the ground pattern continued and formed in the predetermined range on a printed-circuit board so that each isolation field might be separated and some of inputs and output circuit patterns [at least] might be surrounded, and ** were formed It is characterized by forming insulating Rhine for dividing this ground pattern electrically to an input-side ground pattern and an output side ground pattern in said ground pattern. The input terminal and the output terminal in which invention of claim 2 was formed on the base or side face of a package, The input-side grounding terminal and output side grounding terminal which were formed in the base or side face of a package so that it might become this input terminal and an output terminal with a pair, respectively, It is the printed-circuit board unit which changes. a preparation ****** device and the printed-circuit board carrying this piezo-electric device -- since -- to said printed-circuit board The input circuit pattern corresponding to an input terminal, and the output circuit pattern corresponding to an output terminal, The input-side ground pattern corresponding to an input-side grounding terminal, the output side ground pattern corresponding to an output side grounding terminal, and ** are formed, and it is characterized by separating said two ground patterns of each other. The piezo-electric device which has the input-side grounding terminal and output side grounding terminal with which invention of claim 3 serves as an input terminal and an output terminal, this input terminal and an output terminal, and **********, It is the printed-circuit board unit which consists of the printed-circuit board carrying this piezo-electric device. So that the ground potential produced according to the signal current which is supplied from said input terminal and flows to a grounding terminal may mitigate the effect which it has on the output signal outputted from said output terminal It is characterized by dividing the ground pattern on said printed-circuit board into an input-side ground pattern and an output side ground pattern. The electronic instrument of invention of claim 4 is characterized by having a printed-circuit board unit according to claim 1, 2, 3, or 4.

[0006]

[Embodiment of the Invention] Hereafter, the example of a gestalt which showed this invention to the drawing explains to a detail.

When [which is [radical Osamu Motohara of this invention]] mounted on a printed circuit board in advance of explanation of the example of a gestalt, the above-mentioned fault, i.e., piezo-electric device, the cause which degradation of a property generates is considered. In addition, drawing 10 - drawing 13 are referred to collectively. If the cause that the magnitude of attenuation of an inhibition zone falls remarkably is guessed when it mounts on the printed-circuit board 20 with the common ground pattern 21 in the condition that the ground pattern during I/O connected the piezo-electric filter 1 of a high frequency, as mentioned above, it will be thought that it will be the following reason. That is,

considering a band pass mold SAW filter, the signal of a passband frequency flows to a ground through an input side IDT to hardly decreasing but being transmitted to output terminal 12a about the signal of an inhibition zone frequency among the signals supplied to input terminal 13a, and the energy transmitted to output terminal 12a becomes small. although it is called a broad common ground pattern on the other hand as everyone knows -- a potato -- though small, it has the inductance component (function as a coil), and the reactance by the inductance, i.e., a current inhibition component, is proportional to a frequency (X =jomegaL and omega=2pif, L inductance). That is, if the inductance by the common ground pattern 21 exists in the current path to which a part of signal supplied to input terminal 13a flows, in the both ends, the electromotive force proportional to an inductance component, the flowing current, and a frequency will arise. If this electromotive force influences output terminal 12a, what the magnitude of attenuation of an inhibition zone will fall can be understood. If this phenomenon is expressed in an equal circuit, it will become like drawing 8 . that is, that with which the ground pattern between input/output terminals was connected is shown in drawing 8 as usual -- as -- Input IDT and an output IDT -- common -- ground resistance RG or -- and ground inductance LG It was inserted. Therefore, in the signal which appears in an output terminal, it is these ground resistance RG. Ground inductance LG The electromotive force to depend is added and it is surmised that the magnitude of attenuation of an inhibition zone will fall as a result. Then, when a means by which an experiment removed connection of each ground pattern by the side of an input terminal and an output terminal was provided, the property of piezo-electric device original was able to be acquired. It is thought that the equal circuit of drawing 9 could show this phenomenon. The earth line common to Input IDT and an output IDT is lost, and the above-mentioned fault stops namely, occurring, as a result of separating the ground input one end and by the side of an outgoing end. In addition, the above-mentioned effectiveness's being more remarkable in directly under [piezo-electric device], or input one end and the continuation ground part (common ground pattern 21) located in an outgoing end close-attendants side is check ending by experiment. That is, even if the input one end ground and the outgoing end side ground are electrically connected in necessary distance detached building ****** from Input IDT or the output IDT, fault like before may not be produced. Therefore, the fundamental view of this invention is characterized by separating an input one end ground pattern and an outgoing end side ground pattern so that the effect which the ground potential produced according to the signal current which is supplied from an input terminal and flows to a ground pattern has on an output signal may be lost, or so that it may become small.

[0007] [The 1st operation gestalt], next the example of a configuration of the printed-circuit board unit developed based on the above-mentioned principle of this invention are explained. Drawing 1 is the configuration explanatory view of the printed-circuit board unit of the example of 1 gestalt of this invention, and since the thing and configuration of the above-mentioned conventional example are unchanging about SAW filter 1 as a piezo-electric device, it attaches and explains the same sign to the same part as the example shown in drawing 10 . Moreover, the same sign is attached about the part same about a printed-circuit board 20 as drawing 10 . The point divided into the output side ground pattern 31 and the input-side ground pattern 32 has the characteristic configuration of this example of a gestalt by dividing the ground pattern 21 on a printed-circuit board 20 by narrow width band-like insulating Rhine 30. Insulating Rhine 30 is the field to which the substrate top face was exposed by removing to a line the part located among both the circuit patterns 24 and 25 among the common ground patterns 21 shown in drawing 10 , and it is electrically isolated between each ground pattern 31 and 32 by insulating Rhine 30. In carrying the SAW device 1 on the printed-circuit board 20 equipped with such a configuration, it lays so that output terminal 12a by the side of a device and input terminal 13a may be connected with the output circuit pattern 24 and the input circuit pattern 25, respectively, as a dotted line shows. Under the present circumstances, the output side grounding terminals 12b and 12c are connected with the output side ground pattern 31, and the input-side grounding terminals 13b and 13c are connected with the input-side ground pattern 32. When the property of a SAW device was measured about the printed-circuit board unit of such a configuration, as a filter shape is shown in drawing 2 , compared with the case of drawing 12 , the damping property by the side of about 10dB and low frequency has been improved.

[0008] [The 2nd operation gestalt], next drawing 3 are the top views showing the configuration of the printed-circuit board unit of the 2nd operation gestalt of this invention, and conducted the experiment

about a property using what made this unit as an experiment. The piezo-electric device used for the experiment is the one to 3rd length joint duplex mode SAW filter, and since it is the filter which carried out two-piece cascade connection of this, it has two grounding terminals in each an I/O side. Then, insulating Rhine 40 and 41 like illustration was added in order to perform separation between two grounding terminals. These insulating Rhine 40 and 41 is the insulating regions of the shape of a slit drawn from each isolation fields 22 and 23 towards insulating Rhine 30. Grounding terminal 12b of the output side of SAW filter 1 laid in the piezo-electric device installation location by forming insulating Rhine 40 and 41, and the energization path of the ground current between 12c, It constitutes so that the energization path between grounding terminal 13b of an input side and 13c may turn into an alternate route of the outside which does not pass through insulating Rhine 40 and 41, respectively. Thus, when the energization path of a ground current was constituted for a long time and the effect was checked, the **** filter shape shown in drawing 4 was able to be checked. That is, although the filter shape by this example of a gestalt is effectively inferior to the 1st operation gestalt, if compared with the conventional filter shape, it turns out that it is improved sharply.

[Operation gestalt of ** 3rd] drawing 5 is the top view showing the ground pattern in the printed-circuit board unit of the 3rd operation gestalt of this invention, and is a configuration for this to also separate between two grounding terminals. By forming U-shaped insulating Rhine 45 and 46 on the ground pattern 31 corresponding to the grounding terminals 12b, 12c, 13b, and 13c by the side of a device, and 32, respectively, it constitutes from this example of a gestalt so that the energization path of the ground current between grounding terminal 12b of an output side and 12c and the energization path between grounding terminal 13b of an input side and 13c may turn into an alternate route of the outside which does not pass through insulating Rhine 45 and 46, respectively. Although the filter shape by this example of a gestalt was effectively inferior to the thing of the 1st operation gestalt when the property of the SAW device carried on this printed-circuit board was measured, when compared with the conventional filter shape, it turned out that it is improved sharply.

[0009] [the 4th operation gestalt], next drawing 6 be the top views of the printed-circuit board use for the 4th operation gestalt of this invention, and in this example of a gestalt, they lengthen the energization path of the above-mentioned ground current further by lengthening the free end section of U-shaped insulating Rhine 45 and 46 in drawing 5 in a longitudinal direction at a long picture, respectively while removing insulating Rhine 30 out of the example of a gestalt showed in drawing 5 and making the common ground pattern 21 reproduce. That is, it considers so that the energization path of the ground current between output terminal 12b and input terminal 13b and the energization path of the ground current between output terminal 12c and input terminal 13c may be lengthened, respectively. In this example of a gestalt, by making the path of a ground current far rather than separating the ground pattern of an input and an output completely, it thought that the same operation as the case where a ground pattern is separated in RF would be acquired, and experimented also about the configuration as shown in this drawing. Although it was inferior to the case of the 1st operation gestalt a little also about this, the same property improvement effect was able to be checked.

[0010] although [other modification] above-mentioned each example of a gestalt showed the example for which a ground pattern surrounds completely the output circuit pattern 24 and the input circuit pattern 25, some of output circuit patterns 24 and input circuit patterns 25 are surrounded with the output side ground patterns 50 and 51, respectively like wiring which did not pass over this to an example, for example, was shown in drawing 7 (it inserts) -- you may constitute like. And when a piezo-electric device is carried in the piezo-electric device helicopter loading site shown by the dotted line Output terminal 12a and input terminal 13a are connected corresponding to the output circuit pattern 24 and the input circuit pattern 25, respectively. The grounding terminals 12b and 12c located in the both sides of output terminal 12a and input terminal 13a, respectively, and 13b and 13c are connected with the output circuit pattern 24 and the ground patterns 50 and 51 arranged through insulating Rhine 55 and 56 at the both sides of the input circuit pattern 25. Although each above-mentioned example of a gestalt explained as an example the piezo-electric device which carried out two-step cascade connection of the 1 3rd [-] duplex mode SAW filter, the wiring structure of the printed-circuit board of this invention can be applied also when it carries other SAW filters and piezo-electric filters. Moreover, although this invention can be applied also to COB although the chip on-board regulation (COB) type request which carries chips, such as a direct SAW filter, on a printed-circuit board from the demand of a

miniaturization is high in recent years, and the connection between a chip and a circuit pattern can consider wirebonding and the so-called flip chip method at this time, it cannot be overemphasized that it can apply even if it is which method. In addition, in each claim, a piezo-electric device is a concept not only including the type which held the piezoelectric device in the package but chips, such as an SAW filter. Moreover, the printed-circuit board unit of ** [to improvement in the engine performance of each device] shown in each above-mentioned example of a gestalt is clear by carrying this in communication equipment and other electronic equipment.

[0011]

[Effect of the Invention] As mentioned above, according to this invention, when piezo-electric devices, such as a piezo-electric filter, are carried on a printed-circuit board, the printed-circuit board unit from which a filter shape equivalent to the property in the condition the device independent before loading is obtained can be offered. Namely, the input circuit pattern respectively corresponding to [in invention of claim 1] an input terminal and an output terminal to a printed-circuit board top and an output circuit pattern, The isolation field which surrounds some of these inputs and each output circuit patterns [at least], While forming the ground pattern continued and formed in the predetermined range on a printed-circuit board so that each isolation field may be separated and some of inputs and output circuit patterns [at least] may be surrounded Insulating Rhine for dividing this ground pattern electrically to an input-side ground pattern and an output side ground pattern is formed in the ground pattern. When putting this in another way, the input one end ground pattern and the outgoing end side ground pattern were separated so that the effect which the ground potential produced according to the signal current which is supplied from an input terminal and flows to a ground pattern has on an output signal might be lost, or so that it might become small. Thus, since connection of each ground pattern by the side of an input terminal and an output terminal was canceled, the fall of the magnitude of attenuation of an inhibition zone was prevented, and the property of piezo-electric device original was able to be acquired. The earth line common to Input IDT and an output IDT is lost, and the above-mentioned fault stops namely, occurring, as a result of separating the ground input one end and by the side of an outgoing end. In invention of claim 2, the input circuit pattern corresponding to an input terminal, the output circuit pattern corresponding to an output terminal, the input-side ground pattern corresponding to an input-side grounding terminal, the output side ground pattern corresponding to an output side grounding terminal, and ** are formed in the printed-circuit board. In this invention, since connection of each ground pattern by the side of an input terminal and an output terminal was canceled or the passage circuit of the ground current between the grounding terminals on the common ground pattern of which connection is not canceled was made into the alternate route, without limiting the configuration of an I/O circuit pattern and an I/O side ground pattern, arrangement, etc., the fall of the magnitude of attenuation of an inhibition zone was prevented, and the property of piezo-electric device original was able to be acquired. The piezo-electric device which has an input terminal and an output terminal, and the input-side grounding terminal and output side grounding terminal used as this input terminal and an output terminal, and ********** in invention of claim 3, It is the printed-circuit board unit which consists of the printed-circuit board carrying this piezo-electric device. So that the ground potential produced according to the signal current which is supplied from said input terminal and flows to a grounding terminal may mitigate the effect which it has on the output signal outputted from said output terminal Since it separated into the input-side ground pattern and the output side ground pattern, the ground pattern on said printed-circuit board Not only the piezo-electric device that contained the piezoelectric device but a piezoelectric device can be applied also to the printed-circuit board unit of the type carried on the circuit pattern on an immediate printing wiring substrate, and effectiveness equivalent to the case where it is a claim besides the above can be demonstrated. In claim 4, the effectiveness corresponding to each claim can be acquired by carrying a printed-circuit board unit given [above-mentioned / each] in a claim in various electronic instruments.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the microstrip line mold printed circuit board for RF signals which can prevent that an unnecessary electromagnetic wave spreads the inside of a printed circuit board dielectric.
[0002]
[Description of the Prior Art] A configuration like drawing 3 can be considered as an example of the conventional printed circuit board.
[0003] Drawing 3 is a typical sectional view at the time of mounting components using this conventional printed circuit board, and the pad for input signals of the microstrip line configuration on a printed circuit board and the pad for output signals, the dielectric part into which, as for a narrow-band band pass filter (it considers as Following BPF), and 2 and 5, the input terminal of BPF1 and an output terminal, and 6 make three, and, as for four, 1 makes a printed circuit board body, respectively, and 7 are bodies of a housing, such as a shielding case made with the metal. 8 shows the electromagnetic wave which spreads the dielectric part 6 of a printed circuit board from an input side to an output side.
[0004] When the conventional printed circuit board constituted as mentioned above is used, originally, a signal is inputted into BPF1 through an input terminal 3 from the pad 2 for input signals, and only a desired signal component is outputted to the pad 5 for output signals through an output terminal 4 based on the property of BPF1.
[0005] In this example, although they form the body of a shielding case housing, and microstrip line structure, even if the pad 2 for input signals and the pad 5 for output signals prepare the copper foil for glands for alternating current-touch-down in the base of a printed circuit board and form this part and microstrip line structure, they are equivalent in phenomenon.
[0006]
[Problem(s) to be Solved by the Invention] However, since there is change on structural structure with a configuration like drawing 3 in the connection of the pad 2 for input signals, an input terminal 3 and an output terminal 4, and the pad 5 for output signals, Since the continuity of an impedance is spoiled, it is easy to generate the electromagnetic wave 8 which spreads the dielectric part 6 of a printed circuit board from an input side to an output side. And when both sides of the dielectric part 6 of a printed circuit board serve as alternating current-touch-down, the dielectric part 6 of a printed circuit board will be comparatively spread by low loss. In the case of the printed circuit board of microstrip line structure, it tends to become such structure. In such a situation, when you needed a big damping property like a filter and especially an output became smaller than an input, since the magnitude of this electromagnetic wave 8 was not able to be disregarded, it had the technical problem that sufficient damping property was not acquired.
[0007] For example, drawing 4 and drawing 5 express the gain-frequency characteristics of BPF1, and the peak of the passband of original [101] and 102 show the property by the electromagnetic wave 8 in drawing 4 . When extreme, like drawing 4 , the magnitude of two peaks is almost the same, and serves as an insertion-loss-10--20dB value. It is drawing 5 which carried out the enlarged display of the part of 101 in frequency. The several dB damping property near the peak is not acquired, and sufficient property is not acquired.

[0008] Although drawing 6 is the example of a means to solve the above technical problems, in drawing 6 , the input-side printed circuit board from which a partition for 71-1 to prevent propagation of an electromagnetic wave, and 61 and 62 were separated by the partition 71-1, respectively, an output side printed circuit board, and others correspond with the thing in drawing 4 , respectively. The partition 71-1 is united with the body 71 of a shielding case housing.
[0009] However, in the above configurations, the partition had to be prepared in the shielding case, and processing became complicated, and the class of printed circuit board increased only the part whose partition increases, and separation of a printed circuit board had the technical problem that it may be difficult and assembly also became complicated depending on circuitry.
[0010] This invention was made in view of this point, and aims at an unnecessary electromagnetic wave offering the microstrip line mold printed circuit board for RF signals which can prevent spreading the inside of a printed circuit board dielectric.
[0011]
 [Means for Solving the Problem] This invention is the microstrip line mold printed circuit board which arranged and established the KIRI hole or the through hole in high density.
[0012]
[Function] By the above mentioned configuration, this invention can prevent that an unnecessary electromagnetic wave spreads the inside of a printed circuit board dielectric in a KIRI hole or a through hole.
[0013]
[Example] Drawing 1 shows the mimetic diagram of the microstrip line mold printed circuit board for the narrow-band band pass filters (it considers as Following BPF) of the surface mount mold in the 1st example of this invention.
[0014] In drawing 1 , the metallic foil section in which 21 and 51 make the pad for input signals on a printed circuit board and the pad for output signals, and 9 makes the alternating current-touch-down by the side of the component side on a printed circuit board, respectively, and 10 are the KIRI holes or through holes which were established in the printed circuit board, and are prepared 11 pieces by this example. Like the conventional example, although they form the body of a shielding case housing, and microstrip line structure, even if the pad 2 for input signals and the pad 5 for output signals prepare the copper foil for glands for alternating current-touch-down in the base of a printed circuit board and form this part and microstrip line structure, they are equivalent in phenomenon.
[0015] About the microstrip line mold printed circuit board of this example constituted as mentioned above, the configuration and actuation are explained below.
[0016] Although the typical sectional view at the time of mounting BPF using the printed circuit board of this example is almost the same as drawing 3 in the case of the conventional example, it differs in that the KIRI hole or the through hole 10 is formed directly under [BPF1] the printed circuit board. For this reason, it can prevent an electromagnetic wave 8 spreading the dielectric part 6 of a printed circuit board unlike the conventional example.
[0017] The gain-frequency characteristics of BPF1 become like drawing 2 , a property is improved as compared with drawing 5 , the original property of BPF1 is acquired, and the damping property 40dB or more is attained.
[0018] In the microstrip line mold printed circuit board of this example constituted as mentioned above, the magnitude of a KIRI hole or a through hole 10, quantity, an arrangement consistency, etc. are determined depending on the frequency of the object electromagnetic wave which should prevent propagation. As effectiveness of propagation prevention of an electromagnetic wave 8, it becomes large in order of a KIRI hole, a through hole, and the through hole filled with the metal.
[0019] As mentioned above, according to this example, in order to prevent that an electromagnetic wave spreads the dielectric part in a printed circuit board, it is not necessary to prepare a partition and shielding case processing is also easy, separation of a printed circuit board is also unnecessary and the time and effort to assemble is the same as the conventional case.
[0020]
[Effect of the Invention] As explained above, according to this invention, by arranging and establishing a KIRI hole or a through hole in the microstrip line mold printed circuit board for RF signals at high density, it can prevent easily that an unnecessary electromagnetic wave spreads the inside of a printed circuit board dielectric, and the practical effectiveness is large.